



Volume 3

Chapter 4 Central Coast Hydrologic Region

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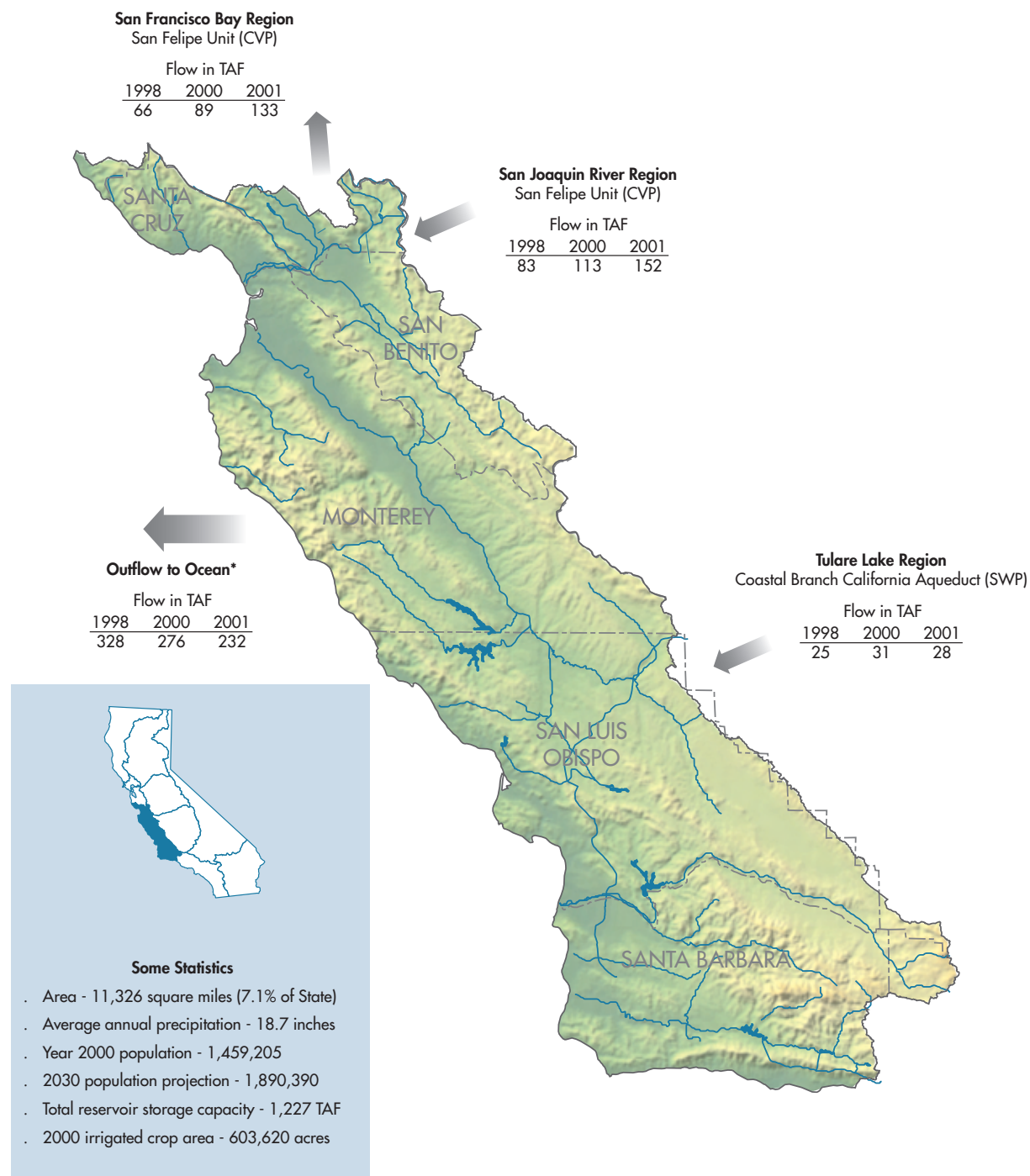
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Figure 4-1 Central Coast Hydrologic Region



The Central Coast Hydrologic Region extends from San Mateo to Santa Barbara counties and is within the Coast Range. Arrows indicate annual flows entering and leaving the region for water years 1998, 2000, and 2001.

*Outflow to Ocean includes Wild and Scenic Rivers, regulated flows, and estimated wastewater outflows.

Chapter 4 *Central Coast Hydrologic Region*

Setting

The Central Coast Hydrologic Region extends from southern San Mateo County in the north to Santa Barbara County in the south (see Figure 4-1). The region includes all of Santa Cruz, Monterey, San Benito, San Luis Obispo and Santa Barbara counties and parts of San Mateo, Santa Clara, and Ventura counties. Many attributes define the Central Coast region including: the topography, many microclimates, the variety of agricultural products, and the picturesque coastline, valleys and communities that drive a thriving tourism economy.

Most of the Central Coast region is within the coastal mountain ranges, which stretch from the northern part of the region into San Luis Obispo and Santa Barbara counties. The portion of the Coast Ranges nearest to the ocean is the Santa Lucia Range, where elevations of a few peaks exceed 4,000 feet. Inland Coast Ranges are composed of the Gabilan and Diablo ranges in the north, the Cholame Hills in the center, and the Temblor and La Panza ranges in the south. The San Rafael and Sierra Madre mountains cover nearly three-quarters of Santa Barbara County. The southernmost quarter of Santa Barbara County is covered by the Santa Ynez Mountains, which are a component of another landform, the east-west trending Transverse Ranges. The mountains in eastern Santa Barbara County attain elevations of about 7,000 feet.

Lowlands in the region include narrow streambeds winding to the coast, coastal terraces and plains of varying sizes, and a few larger river valleys. The largest lowland near the coast is the Salinas Valley. Although less than 10 miles wide for most of its length, it stretches for 120 miles from the community of Moss Landing on Monterey Bay southeastward to near the community of Santa Margarita in San Luis Obispo County. Pajaro Valley is a smaller coastal valley adjacent to the Salinas Valley on the north side of Monterey Bay. Another large lowland near the coast is Santa Maria Valley, which straddles the Santa Maria River. Most of this valley is in Santa Barbara County, but a

portion is also in San Luis Obispo County. The Salinas and Santa Maria valleys are the premier agricultural production areas of the Central Coast. Other significant interior lowlands include San Benito Valley in the far north, the inland Cuyama Valley shared by San Luis Obispo and Santa Barbara counties, and the Lompoc and Santa Ynez valleys in Santa Barbara County. The single largest lowland in the region is the Carrizo Plain in the eastern backcountry of San Luis Obispo County. The Carrizo Plain is a very wide basin on the otherwise fairly narrow but notorious San Andreas Fault Zone, which runs the length of the region.

The Central Coast's rivers generally have a northwest-southeast alignment, reflecting the topographic trend of the region's mountains and hills. The Pajaro, Carmel, and Salinas rivers drain the northern part of this region, the Estrella River and San Juan Creek are in the central portion, and the Cuyama, Santa Maria, and Santa Ynez rivers are in the southern portion. All of the rivers within this hydrologic region drain into the Pacific Ocean.

Climate

The climate of the Central Coast region remains temperate all year due to its location adjacent to the Pacific Ocean. The Central Coast has a Mediterranean climate characterized by mild, wet winters, and warm, dry summers. The regional climate is dominated by a strong and persistent high-pressure system that frequently lies off the Pacific coast. This Pacific high shifts northward or southward in response to seasonal changes or the presence of cyclonic storms. Prevailing winds carry cool, humid marine air onshore. These northwest winds cause frequent fog and low clouds near the coast, particularly at night and in the morning in the late spring and early summer. San Benito County is the only county in the region that does not have a coastline. As a result, temperatures are often higher and fog is prevalent than in the other coastal counties.



Most of the Central Coast region is within the coastal mountain ranges, which stretch from the northern part of the region into San Luis Obispo and Santa Barbara counties. Lone Cypress is a landmark on the Monterey Peninsula. (DWR Photo)

January is the coolest month with an average high temperature of 59 degrees and low temperature of 41 degrees. September is the warmest month with 72 degrees as the average high temperature and 52 degrees lowest. In the northern part of the region, the best weather occurs in September and extends through the middle of November with a few days getting into the 80s and 90s. Summer temperatures are cool along the coast and warmer inland. In the winter, temperatures remain cool along the coast but become cooler inland. The year-round, frost-free climate of the coastal valleys makes them ideal for specialty crops such as strawberries and artichokes.

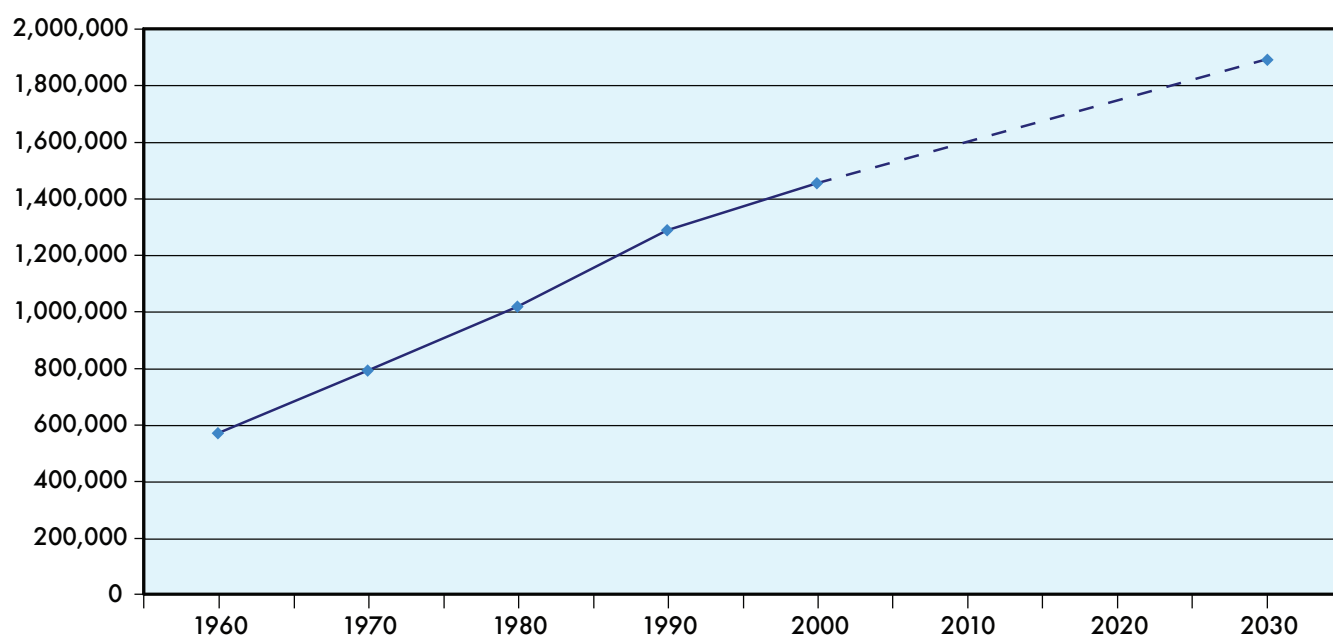
Annual precipitation—usually rain—in the region ranges from 14 to 45 inches. Most of the rain occurs between late November and mid-April. The average annual precipitation near Salinas is about 14 inches. The southern interior basins usually receive 5 to 10 inches per year, with the mountain areas receiving more rainfall than the valley floors. The vineyard-growing areas throughout the region generally have

summers that are long and cool due to the influence of the ocean. High-quality wine grapes thrive in this environment with very moderate climate all summer, with foggy mornings, bright sunshine through the afternoon, and very windy afternoons and early evenings.

The Monterey area, in general, enjoys the mildest climate with the fewest hot and cold days of any place in the continental United States. A prevailing feature of summer weather is the coastal fog or stratus overcast. The low overcast or fog usually burns off in the late morning and moves back in before midnight. During the winter, the coolest areas are inland away from the ocean. Winds are lightest in the winter and strongest in the summer, except for occasional storms.

The most prominent feature in the region is the floor of the Salinas Valley, which is about 7 miles wide at Chualar, 9 miles wide at Greenfield, and 4 miles wide at King City. The microclimate in these coastal areas (Salinas, Pajaro, and Santa Maria val-

Figure 4-2 Central Coast Hydrologic Region population



Data from California Department of Finance provide decadal population from 1960 to 2000, and population projection for 2030 for the Central Coast region.

leys) is ideal for growing truck crops and are well known for growing lettuce, broccoli, mushrooms, strawberries, citrus, and several other crops. The microclimate in these coastal areas is also ideal for the floral industry and grape vineyards.

At the very southern end of the region is Santa Barbara County. Summers are warm and dry; the winters are cool and often wet. The county has a unique physical orientation, with a series of east-west transverse mountain ranges. This can sometimes produce a profound orographic effect when storms approach the county from the Pacific Ocean. Most rain occurs between November and March. For the most part, Santa Barbara County receives relatively gentle but steady rainfall during storm events. Moist air from the Pacific Ocean moderates temperatures in the coastal areas, and somewhat lower winter minimums and higher summer maximums prevail in the inland valleys.

Population

The population of the Central Coast Region was about 1,459,200 in 2000, slightly more than 4 percent of California's population. About 65 percent of the Central Coast population lives in incorporated cities, which include Salinas

(143,800), Santa Barbara (89,600), Santa Maria (77,400), Santa Cruz (54,600), San Luis Obispo (44,200), Lompoc (41,100), Watsonville (44,300), Hollister (34,400), Seaside (33,500), Monterey (29,700), Atascadero (26,400), and Paso Robles (24,300). There are several communities in the region with populations of fewer than 20,000.

California experienced a population increase approaching 14 percent from 1990 to 2000, while the growth in Central Coast Region was nearly 14 percent. Most of the counties in the Central Coast region reached double-digit population growth rates during these 10 years. The only county with a growth rate below double digits, according to Department of Finance population statistics, was Santa Barbara County, which grew by slightly less than 9 percent. San Benito County exceeded all other counties by recording a 46 percent increase during the decade. The population growth rates for Monterey County, San Luis Obispo County and Santa Cruz County were 13 percent, 14 percent, and 12 percent, respectively. Looking to the future, California Department of Finance estimates that the population of this hydrologic region will grow to roughly 1,890,400 by year 2030, which represents a 30 percent increase from 2000. Figure 4-2

provides a graphical depiction of the Central Coast Region's population from year 1960 through 2000, with projections to year 2030.

Population growth in the region is largely constrained by land-use policies, which limits the development of new housing. The cost of homes in most of the region is well above the national average, with the most costly real estate near the Santa Cruz and Monterey bays, Santa Barbara and greater Salinas area. As with most communities facing high real estate prices, there is a lack of entry and mid-level housing. Prices have been driven up by a lack of new development combined with a high demand by people moving into this region. The high cost of housing in the city of Santa Barbara is resulting in a 'flight to affordability,' as more workers are commuting into the city from nearby Santa Maria and the Santa Ynez Valley. Likewise, workers also commute to jobs in the major metropolitan areas from communities such as Salinas, Hollister, and some locations in the San Joaquin Valley, including Tracy, Los Banos, Patterson, and Modesto.

Land Use

The busy topography of the Central Coast Region and distance from California's major population centers have resulted in a landscape that is primarily pastoral and agricultural. Major economic activities include tourism, agricultural-related processing, as well as government and service-sector employment. Oil production and transportation sites onshore and offshore are important to the economy.

Agriculture in the Central Coast region can be divided into two distinct categories. One is irrigated vegetable and specialty crops grown on coastal terraces and valleys and in some inland valleys; and the other category is range pasture and dry-farmed grain in the inland valleys. The acreage planted in wine grape is expanding rapidly and now represents the region's highest-value individual agricultural commodity. Vineyard acreage region-wide grew 34 percent between 1998 and 2001. Although wine grapes are the highest-value individual agricultural commodity in the region, the category of vegetable crops still generates the highest dollar value. Livestock operations, mainly cattle, also are significant in the region.

Total irrigated land acreage in the Central Coast region has increased slightly from 422,000 acres in 1990 to 438,800 acres in 2000, or about 4 percent. However, because of the significant increase in the practice of growing multiple crops in a single year on the same piece of land, the total crop

acreage increased from 534,400 acres in 1990 to 605,000 acres in 2000, a 13 percent increase. This increase in farm productivity through multi-cropping is a practice that is applied primarily to vegetable crops because of their relatively short growing season.

The acreage of field crops in the region has been declining for several years. It is now rare to find sugar beets grown in the region, and the two processing plants in Spreckles and Santa Maria that once took delivery of local sugar beets have both closed. Other field crops whose production has declined are corn, alfalfa, and irrigated pasture. However, the loss of field crop acreage has been offset by the increases in vegetable and truck crops. According to Monterey County Agricultural Commission statistics, lettuce acreage was 58,000 acres in 1990, and by year 2000 it had increased to 106,000 acres. Value-added products such as packaged salads, baby lettuce mixes, and specialty bag mixes have created a large demand for the many types of lettuce grown in the region, as well as for specialty greens.

The two premier vegetable-growing centers in the Central Coast region are the highly productive Salinas Valley in the north and the smaller Santa Maria Valley in the south. Year-round multiple cropping of vegetables is the predominant farm practice in these areas. The results from a multiple cropping field study conducted by the Department of Water Resources in the Salinas Valley in 1997 indicated that more than 100,000 acres was multiple cropped, which is about 40 percent of the irrigated land in the northern half of this hydrologic region.

From 1992 to 1998, the region lost more than 14,400 acres of agricultural land to urban uses (California Department of Conservation figures). However, growers have compensated for the loss of agricultural land through increased use of multi-cropping and the use of nonirrigated pasture lands. In 2001 over 250,000 acres of land was devoted to the production of irrigated vegetables and specialty crops. However, because of multi-cropping practices, over 400,000 acres of specialty crops were harvested.

Citrus and subtropical fruit crops, chiefly avocados and lemons, are grown on nearly 14,000 acres in the southern parts of this region. More than three-quarters of this acreage is near Santa Barbara. Nearly 14,000 acres of irrigated deciduous fruit trees, mostly walnuts, are also grown in the region, primarily in San Luis Obispo and San Benito counties. Vineyard acreage is evenly distributed between the northern and southern parts of the region. However, the vineyard acreage in the southern areas has grown rapidly from 27,100

acres in 1998 to 46,500 acres in 2001. Total grape acreage for the full hydrologic region grew from 68,100 to 95,600 acres between 1998 and 2001. Wineries with tasting rooms have become an important part of the region's travel and tourism industry.

Publicly owned lands, including military reservations, federally managed areas, and parks, make up about 28 percent of the Central Coast region. One of the main environmental water uses in the region is for the Salinas River National Wildlife Refuge, which is on 366 acres where the Salinas River empties into Monterey Bay. The refuge is part of the San Francisco Bay National Wildlife Refuge Complex, headquartered in Fremont. Refuge lands include a range of terrestrial and aquatic habitats, including coastal dunes and beaches, grasslands, wetlands, and riparian scrub. Because this wildlife refuge is within the Pacific Flyway, it is used by a variety of migratory birds for breeding, wintering, and rest stops during migration. It also provides habitat for several threatened and endangered species.

Water Supply and Use

Groundwater is the primary source of water in the region, accounting for roughly 75 percent of the annual supply in 2000. Local and some imported surface water supplies make up the rest of the available water for this region. A significant amount of groundwater recharge is provided by the Pajaro, Salinas, and Carmel rivers, and by the Arroyo Seco, which flows into the Salinas River. Also, some water from local reservoirs is used to recharge groundwater. San Clemente and Los Padres dams on the Carmel River in Monterey County, San Antonio Dam on the San Antonio River, also in Monterey County, and Nacimiento Dam on the Nacimiento River in San Luis Obispo County are the region's main reservoirs. Figure 4-3 shows all of the water supply sources used to meet developed water uses in the region for 1998, 2000, and 2001 and summarizes all of the dedicated and developed urban, agricultural and environmental water uses within this hydrologic region for those years.

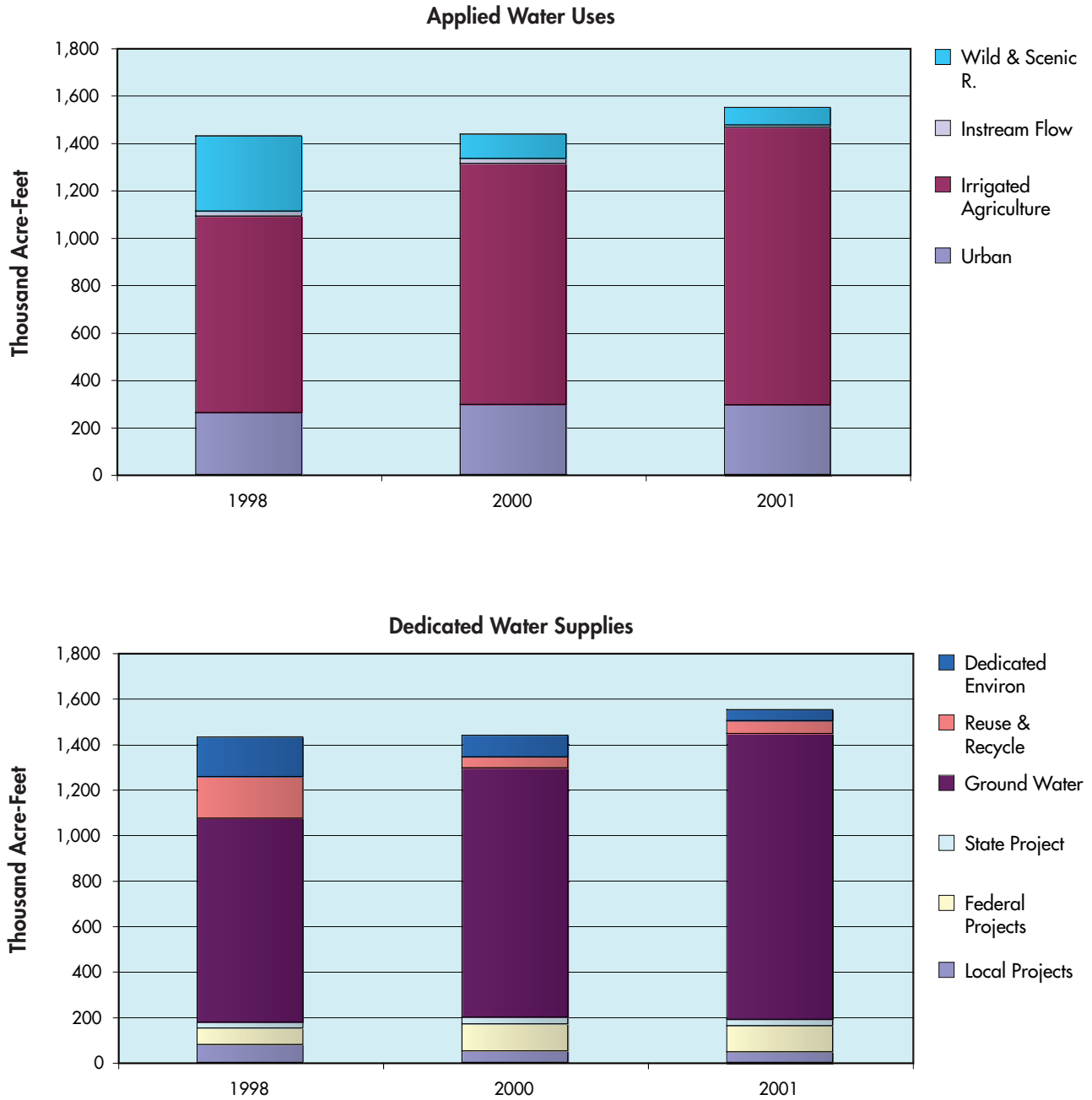
Water agencies in the northern half of this region include Monterey County Water Resources Agency, Monterey Peninsula Water Management District, Marina Coast Water District, California American Water, California Water Service Co., Sunnyslope County Water District, Pajaro Valley Water Management Agency, the City of Santa Cruz, San Benito County Flood Control and Water Conservation District, and a portion of the Santa Clara Valley Water District (Llagas

subbasin). Water agencies in the southern parts of the region include the San Luis Obispo County Flood Control and Water Conservation District and the Santa Barbara County Flood Control and Water Conservation District and numerous cities, special districts, community services districts, and public utility companies. The Central Coast Water Authority is a larger regional agency that includes many of the individual water entities as members.

Historically, almost all of the applied irrigation water was developed from groundwater until the San Felipe Unit of the U.S. Bureau of Reclamation's Central Valley Project began importing surface water for irrigation in June 1987. The CVP's contracts for deliveries to the Santa Clara Valley Water District and the San Benito County Water District from the San Luis Reservoir total 196,300 acre-feet per year, which includes 138,250 acre-feet per year for municipal use and 58,050 acre-feet per year for agricultural uses. There are two other USBR projects in the region. The Cachuma Project provides Santa Ynez River water to the communities of Carpinteria, Goleta, Montecito, Santa Barbara, and Santa Ynez from the 190,000 acre-foot Cachuma Reservoir through the Tecolote Tunnel and South Coast Conduit. The USBR also operates the Santa Maria Project, which provides water from Twitchell Reservoir on the Cuyama River for irrigation purposes in the Santa Maria area. Another federal reservoir, the U.S. Army Corps of Engineer's 26,000 acre-foot Santa Margarita Lake provides water to the city of San Luis Obispo. The 40,700 acre-foot Whale Rock Reservoir near Cayucos is owned by the Whale Rock Commission and provides water to the City of San Luis Obispo and surrounding communities. Surface water is also imported into the region through the State Water Project's Coastal Branch Aqueduct, which was completed in 1997 and can deliver up to 70,500 acre-feet per year into San Luis Obispo and Santa Barbara counties.

California American Water, which is the primary urban water supplier to about 100,000 residents on the Monterey Peninsula area, currently (year 2004) obtains about 75 percent of its water from wells in the Carmel Valley alluvial aquifer. The remaining 25 percent is supplied from wells in Seaside Basin groundwater aquifers. No water is produced by direct diversion from San Clemente Reservoir on the Carmel River as a result of operational changes due to dam seismic safety concerns. In recent years, the State Water Resources Control Board regulation has limited available supplies, such that new water supply sources must be developed before additional regional growth can be supported. Although California-American Water Company had previously proposed building a new dam on the Carmel River, the company is now study-

Figure 4-3 Central Coast region water balance for water years 1998, 2000, 2001



Three years show a marked change in amount and relative proportions of water delivered to Central Coast region's urban and agricultural sectors and water dedicated to the environment (applied water, top chart), where the water came from, and how much water was reused among sectors (dedicated water supplies, bottom chart).

ing an alternative plan called the Coastal Water Project. This project proposes an ocean desalination plant in the Monterey Bay region and development of a conjunctive groundwater storage program for the aquifer in the Seaside area. Additional planning studies, environmental impact analysis, and regulatory agency approvals must be completed before new water supply facilities can be completed.

Desalination of seawater is another source of water within this region. The 1987-1992 drought resulted in the construction of several small seawater desalting plants. The city of Santa Barbara built an 8-million gallons per day plant that was to provide water during water shortages. However, this plant is now inactive, and most of its equipment has been removed. A small plant also was built for the California Department of Parks and Recreation at the San Simeon Beach State Park to serve the Hearst Castle Visitor's Center. That plant was removed when a surface water alternative was later acquired. The city of Morro Bay built a seawater desalting plant and still operates it intermittently during water shortages.

Today, there are seven small seawater-desalting plants along the Central Coast. Of these, only one, Marina Coast Water District, provides municipal water, but it is currently not being used. The other six provide water for offshore islands or for industrial use. There are several large (greater than 1-million gallons per day) seawater desalting proposals under consideration by agencies in the Monterey-Santa Cruz area. If approved and constructed, the total capacity of these proposed plants could be about 20,000 acre-feet per year. Farther to the south, there is also a smaller desalting plant under study to supplement water supplies for the Cambria area.

Water recycling is also becoming a more important water resource. For example, Santa Barbara County has three wastewater treatment plants that recycle wastewater for irrigation, and dust control and compaction at construction sites. In addition, Laguna Sanitation District is designing wastewater treatment and recycled water distribution plants that will be used to serve a golf course and several other irrigation water customers in the city of Santa Maria.

Monterey County has two major wastewater recycling projects. The Castroville Seawater Intrusion Project provides approximately 19,000 acre-feet per year to replace coastal groundwater pumping for irrigating vegetables and fruit crops. The Carmel Area Wastewater District/Pebble Beach Community Services District Reclamation Project replaces approximately 700 acre-feet of potable water for golf courses and other open space in Pebble Beach.

Table 4-1 provides information about the water and its uses in the region for 1998 (a very wet year), 2000 (a year with slightly above normal precipitation), and 2001 (a below average precipitation year for most of the state, but slightly above average for the Central Coast region). Agriculture is the main user of water in this region, accounting for roughly 71 percent of the region's total water use in year 2000. Environmental water use consists primarily of the river flows from two federally designated wild and scenic rivers, the Big Sur River and the Sisquoc River. Because the flow of these two rivers varies considerably depending on the type of water year, total environmental water use can be as much as 24 percent of all uses in a wetter year (1998), or as little as 5 percent of the total water use in a drier year. Urban water use is about 21 percent of the total developed and dedicated water uses in the Central Coast region.

Per capita urban water use in many parts of the region remains at or below urban usage levels from the late 1980s. This decline can be traced to the aggressive use of water conservation programs and mandatory water use reductions during the 1987-1992 drought. The city of Santa Barbara is a good example. Shortages from one of its major supplies, the Cachuma Reservoir Project, forced the city to intensify its conservation and rationing. In 1988, the average daily per capita water use for Santa Barbara was estimated at 164 gallons per day. That value dropped to 94 gallons per capita day during the worst part of the drought in 1990. More recently, year 2000 estimated water use was 133 gallons per day, which is still about 20 percent lower than per capita usage in 1988. Similar trends toward improved water conservation and lower per capita water use have occurred in many other urban areas of the Central Coast region.

State of the Region Challenges

With the Central Coast's limited surface water supply and few large surface water storage facilities, the growing demand for water is leading to more dependence on groundwater. In some of the coastal groundwater basins, groundwater is pumped at a higher rate than the underground supply can be replenished, such that seawater has pushed into some coastal freshwater aquifers and is degrading groundwater quality. There are some places, such as the Seaside Groundwater Basin and the Carmel River Groundwater Basin in the Monterey Peninsula Water Management District, where seawater intrusion has been prevented by rigorous monitoring and management to limit groundwater well production to safe yields. However, in

Table 4-1 Central Coast Hydrologic Region water balance summary - TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	Water Year (Percent of Normal Precipitation)		
	1998 (225%)	2000 (110%)	2001 (107%)
Water Entering the Region			
Precipitation	25,202	12,596	11,848
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	0	0	0
Imports from Other Regions	108	144	180
Total	25,310	12,740	12,028
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	622	754	860
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	66	89	133
Statutory Required Outflow to Salt Sink	174	95	49
Additional Outflow to Salt Sink	154	181	183
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	24,502	12,362	11,688
Total	25,518	13,481	12,913
Storage Changes in the Region			
[+] Water added to storage			
[-] Water removed from storage			
Change in Surface Reservoir Storage	401	8	-14
Change in Groundwater Storage **	-609	-749	-871
Total	-208	-741	-885
Applied Water * (compare with Consumptive Use)	1,074	1,291	1,442

***Footnote for applied water**

Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

****Footnote for change in Groundwater Storage**

Change in Groundwater Storage is based upon best available information. Basins in the north part of the state (North Coast, San Francisco, Sacramento River and North Lahontan regions and parts of Central Coast and San Joaquin River regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =
intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

other coastal areas such as the mouth of the Salinas River, seawater intrusion into the groundwater aquifer is a major threat to water quality.

Unique coastal resources, such as Morro Bay and Monterey Bay, as well as the Salinas Valley, are the focus of water quality issues. Sedimentation poses the greatest water quality threat to Morro Bay, one of 28 estuaries in the National Estuary Program. The bay is also contaminated by pathogens from agriculture, boats, and urban runoff; nutrients from fertilizers, animal wastes, and urban runoff; heavy metals from abandoned mines in the upper watershed; and offshore boatyards that contaminate sediment. Elevated levels of bacteria have closed many of the shellfish growing beds in Morro Bay, and have occasionally closed beaches in Santa Cruz County and southern Santa Barbara County. To protect special areas of biological significance, waste discharges are prohibited or limited in portions of Monterey Bay, a National Marine Sanctuary, and other specific coastal and ocean waters of the region. In its triennial review, the Central Coast Regional Water Quality Control Board also identified the need to incorporate new microbiological standards for water-contact recreation in this region.

In the southern portion of Santa Clara County, elevated concentrations of nitrate and perchlorate have been detected. The Santa Clara Valley Water District continues to implement a Nitrate Management Program to monitor nitrate occurrence, reduce nitrate exposure, and reduce nitrate loading throughout Santa Clara County. The district also provides in-field technical assistance to the regions agricultural growers about nitrate and irrigation management. In late 2002, perchlorate (a chemical used in the manufacture of rocket fuel, road flares, and fireworks), emerged as a significant groundwater contaminant in the southern end of Santa Clara County. The known extent of this groundwater chemical plume extends 10 miles, and more than 800 water supply wells have been affected. The Santa Clara Valley Water District is working with the Regional Water Quality Control Board, local agencies, and affected communities to develop and implement a long-term corrective action plan.

The Salinas River watershed has significant nitrate contamination related to agriculture, the valley's main land use. Groundwater overdraft is also a problem in the area, and seawater has now intruded 6 miles inland into the shallow groundwater aquifer around Castroville. The nearby Pajaro River watershed faces a variety of water quality threats, such as erosion (primarily from agricultural practices), urban runoff, sand and gravel mining, flood control projects, off-road vehicles,

and historical mercury mining in the Hernandez Lake area. Coastal wetlands in Elkhorn Slough, a tributary to Monterey Bay between the Salinas and Pajaro rivers, suffer from erosion on strawberry and other cropped lands in its watershed. Elevated bacterial levels in the slough may be associated with a large dairy and waste operation in the watershed as well as septic tanks. In addition, more than 600 year-round vessels use the Moss Landing Harbor, which increases the waste load to the slough. The accumulated effects of these water quality problems, along with the resuspension of pesticides in sediments, have restricted shellfish growing in Elkhorn Slough.

Other regional water quality concerns include one of the nation's worst oil spills at Unocal's Guadalupe Oil Field in the Santa Maria River watershed. Nutrients and pathogens impact the San Lorenzo River Basin, from septic systems, horse corrals, and urban runoff, as well as erosion from logging, urban development, and road maintenance. Groundwater basins that are impacted by salinity include the Hollister area, the Carrizo Plain, the Santa Maria and Cuyama valleys, San Antonio Creek Valley, portions of the Santa Ynez Valley, and the Goleta and Santa Barbara areas.

California American Water is the primary water supplier to most of the Monterey Peninsula, and the Carmel River is its primary source of water. In 1995, a major State Water Resources Control Board order ruled that the company did not have a legal right to roughly 70 percent of the surface water it had been diverting from the Carmel River. As a result, California American Water has been forced to take more water from wells that draw from groundwater below the lower valley, in order to keep as much water as possible in the river. Essentially no surface water is now taken from the river's two reservoirs behind the San Clemente and Los Padres dams for municipal supply purposes. To offset this lack of surface water, California American Water and the Monterey Peninsula Water Management District have each made separate proposals for seawater desalination plants that would produce enough water to satisfy the state order and put a minimum of 8,000 acre-feet of water a year back into the Carmel River. However, as proposed neither project will be able to supply water for future urban growth and in-fill housing needs.

Accomplishments

Many water districts have programs to monitor, evaluate, and better manage their groundwater resources. Watershed programs are under way to reduce nonpoint pollution, reduce stream erosion, and improve riparian vegetation. For example, the Coastal Watershed Council was formed in response to

the declining health of the watersheds of the Monterey Bay. Its mission is to restore the watersheds of the region and teach its residents how to become stewards of their creeks and streams.

The Carmel River Basin, though small compared to other watersheds, supports a key run of steelhead, a federally listed species. The Monterey Peninsula Water Management District has a program to offset the environmental effects of diversions from the Carmel River that are required to meet the peninsula's water needs. Activities include steelhead rescues when the river is dry, fish rearing and release, restoring riparian habitat, and protecting riverbanks. MPWMD works with others, including the Carmel River Steelhead Association and the Carmel River Watershed Conservancy.

In January 2003, the Pajaro Valley Water Management Agency attempted to negotiate a \$25 million agreement for water to be acquired from the Central San Joaquin Valley's Broadview Water District near the city of Firebaugh in Fresno County. Because of agricultural drainage and economic problems, Broadview Water District farmers have allowed about one-third of their 9,100 acres to lie fallow in recent years, while selling part of their contracted CVP water deliveries. The proposed agreement was intended to implement part of the Pajaro Valley Water Management Agency's plan to use imported surface water as an alternative source, which would reduce groundwater over-pumping and, thus, seawater intrusion. The negotiations between Pajaro Valley and Broadview Water District continued into 2004; but unfortunately the deadline to complete an agreement passed without a final pact being negotiated. Subsequently, Westlands Water District initiated discussions with Broadview Water District for the purchase of district lands and the CVP water. In a notice it sent to district landowners in September 2004, Westlands stated that the negotiations had been completed, and it hoped to finalize the agreement by February 2005.

In 1998, the Monterey County Water Resources Agency and the Monterey Regional Water Pollution Control Agency (RWPCA) completed a \$78 million Salinas Valley reclamation project and Castroville seawater intrusion project. These two projects consist of a 19,500 acre-feet per year tertiary treatment plant and a distribution system that provides about 13,000 acre-feet of recycled water to 12,000 acres of Castroville area farms. During periods of the low irrigation demand in the winter, early spring and late fall, this recycled water supplies most of the water needed for irrigation. These projects will reduce groundwater pumping in the project area, and thus are expected to reduce seawater intrusion. Another project

that will help alleviate Salinas Valley's seawater intrusion is the \$18.8 million Salinas Valley Water Project. The project has two parts: (1) a seasonal rubber dam on the Salinas River near Marina to deliver more fresh water to the saltwater-plagued areas near Castroville and (2) the modification of upstream river operations at San Antonio and Nacimiento lakes to provide higher summer flows to recharge Salinas Valley aquifers. Final planning, financing, and permit approvals are being obtained, and it is anticipated that this project will be constructed in year 2005.

A regional approach to water supply development has been evolving in recent years in San Luis Obispo County. By setting aside regional disagreements the City of San Luis Obispo and Paso Robles, as well as the County of San Luis Obispo, Atascadero Mutual Water Company, and the Templeton Community Services District have agreed to build the Nacimiento Water Project to convey water via pipeline from Lake Nacimiento to the City of San Luis Obispo and locations in between. The county has had rights to 17,500 acre-feet of water per year from Lake Nacimiento since 1959, and recently approached various water agencies and public entities within its boundaries to discuss use of this untapped supply. Currently, the cost of construction for this proposed project is estimated to be about \$150 million. Proposed water purchases to fund this project currently anticipate (1) \$51 million from Paso Robles for 4,000 acre-feet per year, (2) \$30 million from Atascadero Mutual for 2,000 acre-feet per year, (3) \$64 million from City of San Luis Obispo for 3,380 acre-feet per year, and (4) \$3.6 million from Templeton CSD for 250 acre-feet per year. The project design is now under way, and the proposed schedule anticipates that construction would start in early 2007 and be completed by the end of year 2009.

Relationship with Other Regions

Historically, the communities of the Central Coast region have relied on local surface water and groundwater supplies to meet their needs. The northern part of the region first received imported water with completion of the San Felipe Unit of the federal CVP in 1987. This facility delivers water to San Benito County users primarily for agricultural purposes from San Luis Reservoir in the San Joaquin River Hydrologic Region. Ten years later, the Coastal Branch of the SWP was completed to import water to San Luis Obispo and Santa Barbara Counties from the California Aqueduct in the Tulare Lake Hydrologic Region. There are no other water imports into the Central Coast region. Because there is seldom any excess surface water in this region's watersheds, there are no water exports from this region to other parts of the state.

Looking to the Future

Local water agencies in the Central Coast Hydrologic Region are continually maintaining, servicing, expanding, and updating their water systems (Box 4-1 Ongoing Planning Efforts). Because groundwater is the primary water source for the Central Coast region, water agencies are actively combining groundwater and surface water components into conjunctive use projects. In addition to the implementation of water conservation programs, other water management strategies that are under consideration include recycling, groundwater recovery, water marketing, and desalination.

Regional Planning

Several water agencies, including Marina Coast Water District and Scotts Valley Water District, are developing groundwater management plans and conducting groundwater studies to fill in information gaps about local groundwater conditions.

In its effort to implement its Basin Management Plan (BMP) Alternative B, the Pajaro Valley Water Management Agency (PVWMA) has purchased rights to CVP water from the Mercy Springs Water District (6,250 acre-feet). The PVWMA has also begun pipeline construction to deliver Harkins Slough Project and supplemental well water to coastal growers whose wells have been contaminated by seawater, and is pursuing more than \$50 million in State and federal grants to implement the BMP. The BMP includes new wells, as a supplemental supply and as a source of blend water for wastewater reclamation, and an injection/recovery program for CVP water.

The Monterey Peninsula Water Management District has carried out a multiyear aquifer storage and recovery test program, where excess winter flow from the Carmel River is treated and injected into the Seaside Basin for recovery during dry periods. MPWMD has also funded several hydrogeologic studies of the Seaside Basin, and is in the process of developing a Seaside Basin Groundwater Management Plan.

Many projects and studies are under way in the Central Coast Region to enhance water quality and supply. Several new ocean desalination plants, such as the desalination project in the San City area being studied by Monterey Peninsula Water Management District, are being investigated as potential sources of new water supplies. Many agencies are also considering recycled water projects in conjunction with the construction of new or expanded municipal wastewater treatment plants. Local water users are proposing to raise the height of USBR's Bradbury Dam (Cachuma Reservoir) up to 3 feet to provide more water supply for the enhancement of downstream fish habitat. Additionally, many watershed programs are under way to remediate pollution and sedimentation, to help flood control, and to protect and restore ecosystems.

Water Portfolios for Water Years 1998, 2000, and 2001

Water Year 1998

California experienced a very wet winter in 1998 related to the El Nino weather pattern. Because of the extensive damage caused by El Nino storms, the winter of 1998-99 ranked as the 10th costliest in California history. Particularly hard hit were the coastal valleys, where many agricultural fields remained wet and soggy for the first six months of 1998. Annual rainfall in the Santa Cruz area exceeded 30 inches (193.5 percent of normal), and in the southern part of this region the Santa Barbara NWS station measured almost 47 inches of rainfall (167 percent of normal). For the entire hydrologic region, average annual precipitation was 225 percent of normal amounts, compared to a statewide average of 171 percent of normal annual precipitation.

Total agricultural production in the region was \$3.65 billion (Monterey, Santa Cruz, San Benito, San Luis Obispo, and Santa Barbara counties) in 1998 from 564,600 acres of harvested irrigated crops. This is only a modest increase over 1997, but it is significant considering some of the challenges that the agri-

Box 4-1 Ongoing Planning Efforts

- Carmel River Management Plan
- Carmel River Watershed Council
- Coastal Watershed Council
- Pajaro River Watershed Council
- Pajaro Valley Groundwater Management Plan
- Salinas Valley Water Plan
- Santa Clara Valley Water District Groundwater Management Plan
- Seaside Basin Groundwater Management Plan
- Upper Salinas River Watershed CRMP

cultural industry faced. Most of the farming along the Central Coast involves vegetable crops, and vegetable crop acreage accounted for 72 percent of all irrigated crop acreage. The next largest crop is grapes comprising 12 percent of irrigated crop acreage. The Salinas Valley area produces the majority of the spring and summer vegetable crops, particularly lettuce.

The impact of the wet El Nino phenomenon on the Central Coast region's precipitation was very significant. Growers had little need to irrigate crops during the first four to five months of 1998. The very wet conditions prevented the timely planting of many acres of truck crops. Spring rains delayed planting and negatively affected growing conditions, especially for head lettuce production. There was also a decrease in the value of wine grapes due to the cool wet conditions, even though the acreage of grapes planted continued to increase. Strawberry acreage was slightly less than the prior year, but total strawberry crop value rose due to a shortage early in the season, resulting in higher prices once the berries were harvested. The most significant crop increase in 1998 was attributed to value-added salad products, for which the product value increased by about \$70 million as consumer demand grew. Head lettuce value significantly dropped, primarily as a result of wet spring conditions.

As shown in Table 4-2 the 1998 total on-farm agricultural applied water use in the Central Coast Region was 816,300 acre-feet while total agriculture water use (including conveyance losses) was 829,000 acre-feet, or 58 percent of all uses, which is lower than normal as a result of the heavy precipitation. On a per acre basis, the average on-farm unit applied water was only 1.4 acre foot per acre in 1998. For comparison, year 1995 applied water was over 2 acre-feet per acre. As would be expected, this information verifies that the amount of water needed to irrigate crops is generally much less than normal during wetter years, due to utilization of the effective rainfall. The total agricultural evapotranspiration of applied water, or ETAW, in 1998 amounted to 556,900 acre-feet. The regional average unit ETAW was one acre-foot per acre.

Total urban applied water, including residential, commercial, industrial, and landscape uses, in the region was 261,500 acre-feet for the year. As shown in Table 4-2, urban water use accounted for roughly 18 percent of the region's total water use. Based on available water agency information, the average per capita water use was about 164 gallons per day during this wet year. Since a significant portion of urban water is used for outdoor landscapes, parks and golf courses, the per capita water use is lower than normal during a wet year. Total urban ETAW was 64,800 acre-feet.

Total environmental water demand, including instream flows, wild and scenic rivers, and refuge water diversions, for the region was about 339,000 acre-feet in 1998. This accounted for about 24 percent of total developed water uses for this year. Within the Central Coast region, most of this environmental water is dedicated to the wild and scenic river flow requirements for the Big Sur River and the Sisquoc River.

Total water supplies for the Central Coast region, including local and imported (CVP and SWP) surface water, groundwater, and reuse, amounted to 1.4 million acre-feet.

Water Year 2000

The weather and rainfall amounts for water year 2000 in the Central Coast region were slightly wetter than normal average conditions. Rainfall amounts for representative locations include Santa Cruz with 118 percent of average (36.4 inches), Salinas at 110 percent of average (16.5 inches), Santa Maria at 113 percent of average (14.6 inches) and Santa Barbara at 121 percent of average (21.3 inches). For the entire hydrologic region, average annual precipitation was 110 percent of normal, compared to a statewide average of 97 percent of normal.

Water storage in the Central Coast watersheds was reported as above normal. Average reservoir storage on May 1 was 115 percent of normal with runoff to May 1 measured at 105 percent of normal. The land acreage used for irrigated agriculture continued the past trend of remaining relatively stable. Crop acreage, however, increased 7 percent from 1998 to 2000 to a total of 605,000 acres. This increase in crop acreage is due to expanded use of the practice of growing multiple crops per season on the same piece of land. The estimated amount of multiple cropping in 2000 increased 5 percent and is reflected in the increased acreage of truck crops of 7 percent above 1998 amounts. Truck crops comprised about 72 percent of total crop acreage in this region, while the next largest crop category, vineyard, comprised 15 percent of total acreage.

The year 2000 on-farm agricultural applied water use in the Central Coast region was 999,400 acre-feet, while total agricultural water use was 1,016,300 acre-feet, or 71 percent of all water uses. This amounts to 23 percent more applied water than was estimated in 1998 and is considered to be more representative of agricultural water use under normal hydrologic conditions. Average on-farm unit applied water in 2000 was 1.7 acre-feet per acre, compared to 1.4 acre-feet per acre in 1998. The total agricultural evapotranspiration of

Table 4-2 Central Coast Region Water Use and Distribution of Dedicated Supplies - TAF

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	13.7			10.4			10.3		
Commercial	47.7			52.6			50.0		
Industrial	23.7			24.0			23.7		
Energy Production	14.3			14.3			14.3		
Residential - Interior	101.9			121.2			121.1		
Residential - Exterior	56.3			69.0			70.1		
Evapotranspiration of Applied Water		64.8	64.8		73.3	73.3		74.2	74.2
E&ET and Deep Perc to Salt Sink		24.3	24.3		26.8	26.8		25.8	25.8
Outflow		103.7	103.7		116.7	116.7		113.9	113.9
Conveyance Applied Water	3.9			4.2			4.4		
Conveyance Evaporation & ETAW		3.9	3.9		4.2	4.2		4.4	4.4
Conveyance Deep Perc to Salt Sink		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	261.5	196.7	196.7	295.7	221.0	221.0	293.9	218.3	218.3
Agriculture									
On-Farm Applied Water	816.3			999.4			1,152.1		
Evapotranspiration of Applied Water		556.9	556.9		681.0	681.0		785.9	785.9
E&ET and Deep Perc to Salt Sink		3.0	3.0		4.2	4.2		4.9	4.9
Outflow		33.6	33.6		45.3	45.3		50.3	50.3
Conveyance Applied Water	12.7			16.9			18.7		
Conveyance Evaporation & ETAW		11.8	11.8		14.7	14.7		16.7	16.7
Conveyance Deep Perc to Salt Sink		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Outflow		0.0	0.0		1.0	1.0		1.0	1.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	829.0	605.3	605.3	1,016.3	746.2	746.2	1,170.8	858.8	858.8
Environmental									
Instream									
Applied Water	20.3			21.4			10.8		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Wild & Scenic									
Applied Water	318.6			103.2			73.9		
Outflow		173.5	173.5		94.7	94.7		48.5	48.5
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	0.1			0.1			0.1		
Evapotranspiration of Applied Water		0.1	0.1		0.1	0.1		0.1	0.1
E&ET and Deep Perc to Salt Sink		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Applied Water	0.0			0.0			0.0		
Conveyance Evaporation & ETAW		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Deep Perc to Salt Sink		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Environmental Use	339.0	173.6	173.6	124.7	94.8	94.8	84.8	48.6	48.6
TOTAL USE AND OUTFLOW	1,429.5	975.6	975.6	1,436.7	1,062.0	1,062.0	1,549.5	1,125.7	1,125.7
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	79.2	79.2	79.2	51.1	51.1	51.1	46.0	46.0	46.0
Local Imported Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	18.1	18.1	18.1	56.8	56.8	56.8	59.7	59.7	59.7
Other Federal Deliveries	54.1	54.1	54.1	61.4	61.4	61.4	54.6	54.6	54.6
SWP Deliveries	24.8	24.8	24.8	30.9	30.9	30.9	28.0	28.0	28.0
Required Environmental Instream Flow	173.4	173.4	173.4	94.7	94.7	94.7	48.4	48.4	48.4
Groundwater									
Net Withdrawal	608.5	608.5	608.5	749.0	749.0	749.0	870.5	870.5	870.5
Deep Percolation of Surface and GW	288.5			344.8			387.6		
Reuse/Recycle									
Reuse Surface Water	165.4			29.9			36.2		
Recycled Water	17.5	17.5	17.5	18.1	18.1	18.1	18.5	18.5	18.5
TOTAL SUPPLIES	1,429.5	975.6	975.6	1,436.7	1,062.0	1,062.0	1,549.5	1,125.7	1,125.7
<i>Balance = Use - Supplies</i>	<i>0.0</i>	<i>0.0</i>	<i>0.0</i>	<i>0.0</i>	<i>0.0</i>	<i>0.0</i>	<i>0.0</i>	<i>0.0</i>	<i>0.0</i>

applied water, or ETAW, in 2000 amounted to 681,000 acre-feet, which was 22 percent greater than 1998. The regional average unit ETAW was 1.1 acre-feet per acre.

Total urban applied water use for the Central Coast region was 295,700 acre-feet, which was 13 percent higher than the total applied water for 1998. Average per capita water use was about 181 gallons per day, which is about 10 percent higher than 1998 usage. Urban applied water accounted for about 21 percent of the total water use in the region. Total population in the region during year 2000 was 1,459,200, which is an increase of about 3.6 percent over the 1998 population. When compared to the 1998 wet year, the above increases in urban water use are primarily due to significantly less rainfall in year 2000 than in 1998, which means that more urban water was needed for outdoor landscape, parks and golf courses. Total urban ETAW was 73,300 acre-feet, which is 13 percent more than in 1998.

Total environmental water demand (instream, wild and scenic, and refuges) for this region in year 2000 was about 124,700 acre-feet, a significant 63 percent less than 1998. This accounted for about 8 percent of total developed and dedicated water uses during year 2000. This is water that is reserved for instream and wild and scenic river flows, which are generally higher in the wetter years (like 1998) and decline to lower flow levels in average and drier years.

Total water supplies, including local and imported (CVP and SWP) surface water, groundwater, and reuse, amounted to 1.4 million acre-feet, about the same as 1998.

Water Year 2001

The weather and precipitation for water year 2001 in the Central Coast Region varied considerably from north to south. The total rainfall recorded in Santa Cruz was 82 percent of average (25.4 inches), Salinas was at 90 percent of average (13.5 inches), King City was at 116 percent of average (12.8 inches) and Santa Barbara received 146 percent of average precipitation (23.5 inches). For the entire hydrologic region, average annual precipitation was 107 percent of normal, compared to a statewide average of 72 percent. The winter season 2001 was characterized by a lack of rainfall across the region during October through December.

Surface water runoff in the watersheds of the Central Coast region was reported as below average, with accumulated runoff to May 1 measured at 70 percent of average amounts. However, reservoir storage on May 1 was 135 percent of

average because of significant storage carryover from the previous year. Total cropped acreage in 2001 was 601,900 acres, which was very similar to year 2000. In 2000, the prices of many of the core crops grown in the region had increased significantly. However, in 2001, many of these same crops had lower production amounts and price declines. Head lettuce, broccoli, cauliflower, and celery production all experienced decreases in 2001.

Year 2001 on-farm agricultural applied water use in the Central Coast region was 1,152,100 acre-feet, while the total agriculture water use was 1,170,800 acre-feet or 76 percent of all water uses. This amounted to 41 percent more agricultural water use than 1998 and 15 percent more than 2000. Average on-farm unit applied water use per acre also increased in 2001 to 1.9 acre-feet per acre compared to 1.4 acre-feet per acre in 1998 and 1.7 in 2000. As the above data confirms, the need for agricultural applied water increases as the amount of winter precipitation decreases from 1998 (wet) to 2000 and 2001. The total unit ETAW in 2001 was 785,900 acre-feet, which is 41 percent more than 1998 and 15 percent more than 2000. The regional average unit ETAW was 1.3 acre-feet per acre.

In 2001, total urban applied water for the region was 293,900 acre-feet, which was about 12 percent more than 1998 and 1 percent less than year 2000. Average per capita water use was around 176 gallons per day. Urban water use accounted for about 19 percent of the total water use in the region. Total population in the region in 2001 was about 1,476,800, an increase of 1.2 percent from the year 2000 population. Total urban ETAW was 74,200 acre-feet, 15 percent more than 1998 and 1 percent more than in year 2000.

Dedicated environmental water use (instream, wild and scenic flows, and refuges) for the region dropped to 84,800 acre-feet in 2001, 75 percent less than 1998 and 32 percent less than 2000. This accounts for about 5 percent of total developed water uses during this year, and reflects the lower wild and scenic flow volumes in the Big Sur River and the Sisquoc River.

Total available water supplies, including local and imported (CVP and SWP) surface water, groundwater, and reuse, amounted to 1.5 million acre-feet in 2001, which is an 8 percent increase from 1998 and 2000.

Water Portfolio Table 4-3 and the companion Water Portfolio flow diagrams (Figures 4-4 and 4-5) provide more information about how the available water supplies are distributed and used on a region-wide basis.

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